



Bellcomm

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from: H. F. Connor, W. W. Ennis

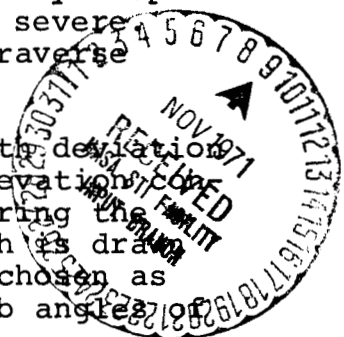
subject: LRV Tilt During Negotiation
of Steep Slopes -- Case 310

MEMORANDUM FOR FILE

LRV operations on the slopes of Stone Mountain are under consideration in the present planning of traverses for the Apollo 16 mission to Descartes. It is often assumed in discussion of such LRV operations that steep slopes may be easily negotiated by "switchbacking." This involves heading the vehicle at a more or less acute angle to the local elevation contours instead of along the direction of maximum slope normal to the contours; a steep slope is then climbed or descended in a zigzag path each leg of which has as small a climb angle as is desired. While switchback roads and tracks laid out on this principle are invariably graded so that the axles of vehicles using them remain approximately horizontal, the employment of this technique on unmodified open-country slopes results in a lateral vehicle tilt that can be quite severe. This effect should be taken into consideration in traverse planning.

The attached figures show the required path deviation (angle between the vehicle heading and the local elevation contour line) and the resulting vehicle (axle) tilt during the negotiation of smooth slopes up to 40 degrees. Each is drawn for a particular vehicle climb angle that might be chosen as an upper limit for mission planning purposes. Climb angles of 10, 15, and 20 degrees are shown.

An example of the severity of the effect can be seen by referring to Figure 2, where it is assumed that a maximum climb angle of 15 degrees has been selected. If a 20-degree slope must be negotiated at this climb angle, the vehicle should be steered about 49° from the local contour line (41° from the



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(NASA-CR-123230) LRV TILT DURING
NEGOTIATION OF STEEP SLOPES (Bellcomm, Inc.)

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direction of steepest slope); the vehicle tilt at this heading will be about 13 degrees. Surface roughness effects could be expected to aggravate the problem still further.

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Attachments

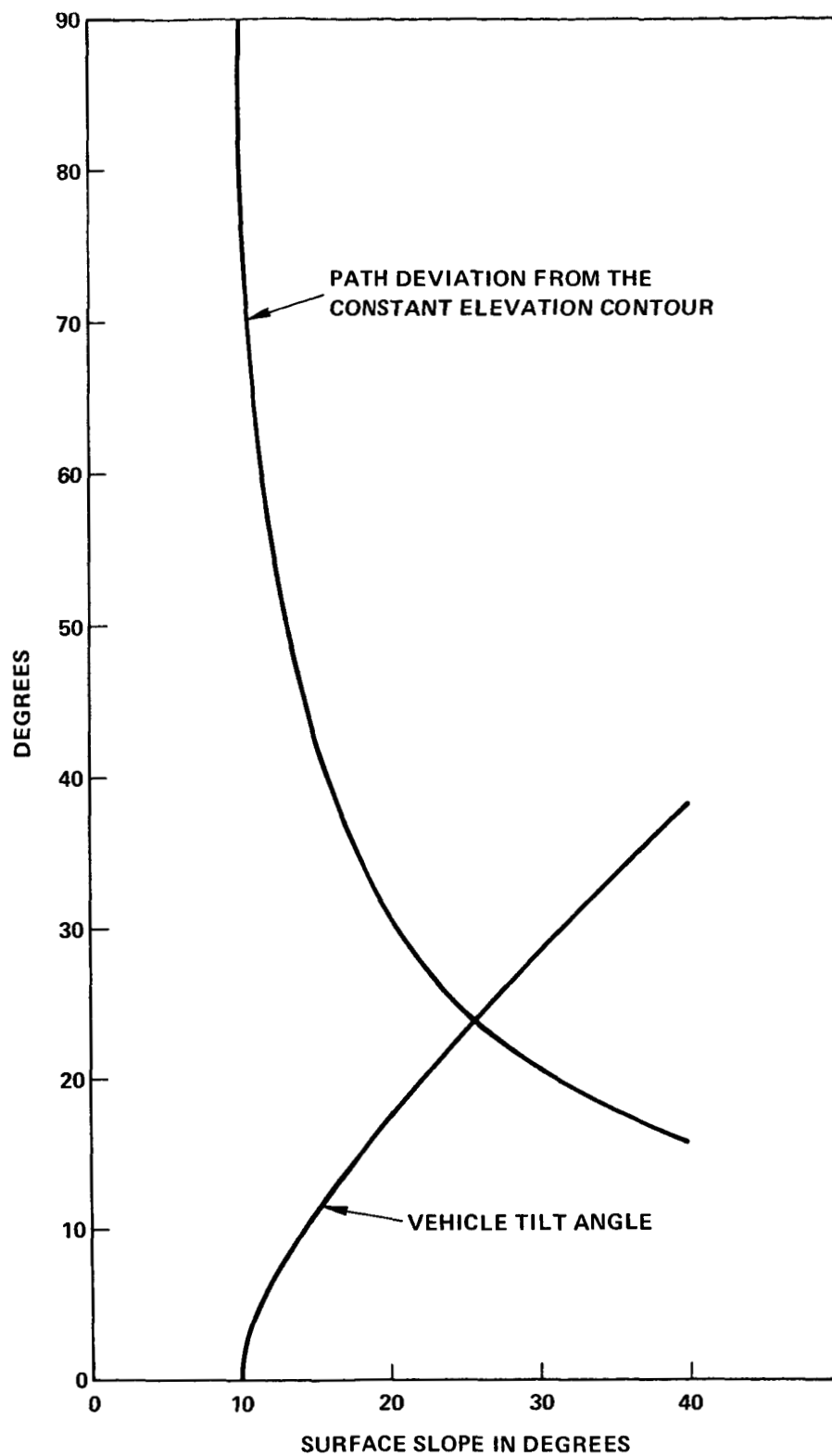


FIGURE 1 - PATH DEVIATION AND VEHICLE TILT FOR 10-DEGREE VEHICLE CLIMB ANGLE

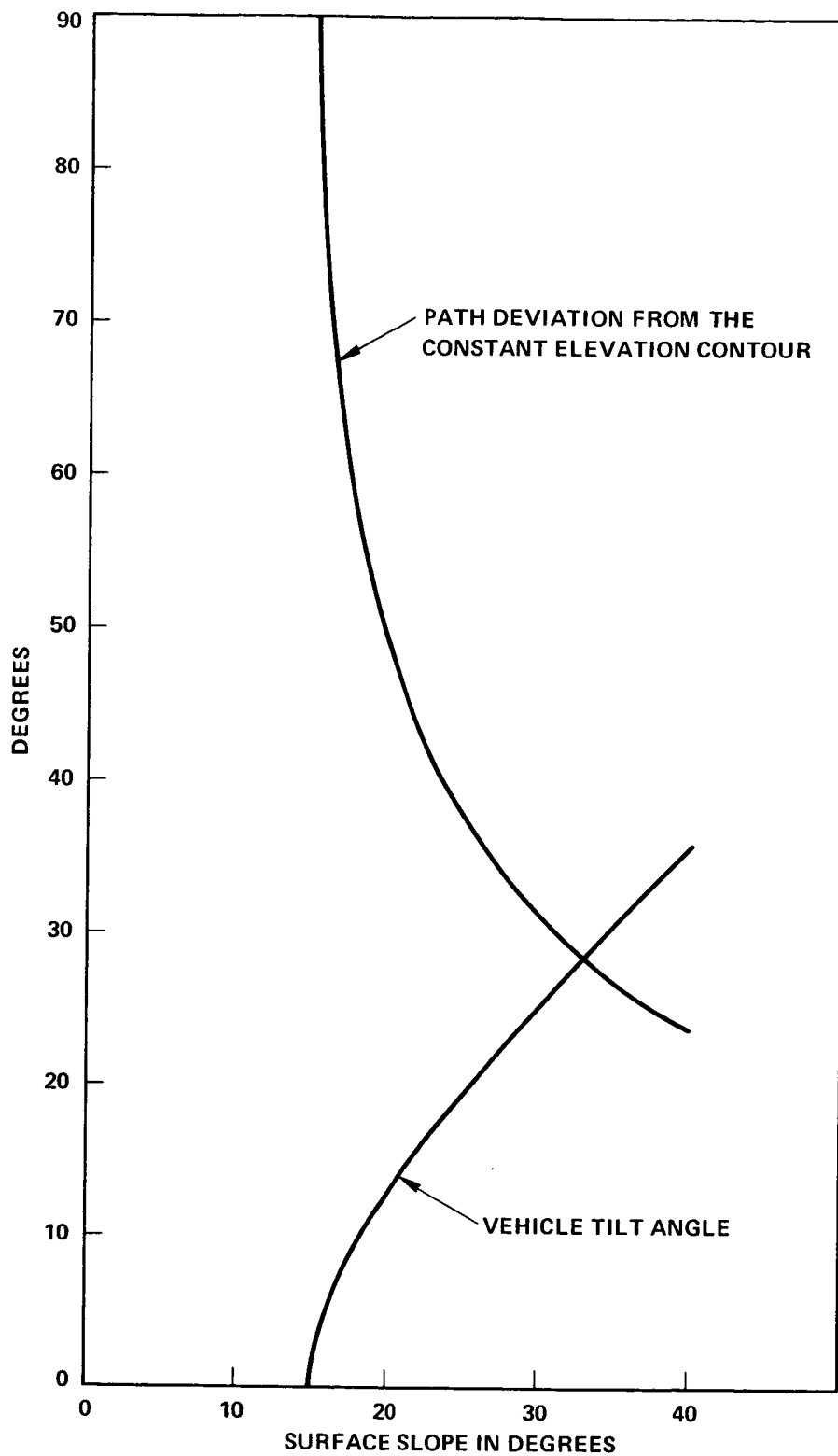


FIGURE 2 - PATH DEVIATION AND VEHICLE TILT FOR 15-DEGREE VEHICLE CLIMB ANGLE

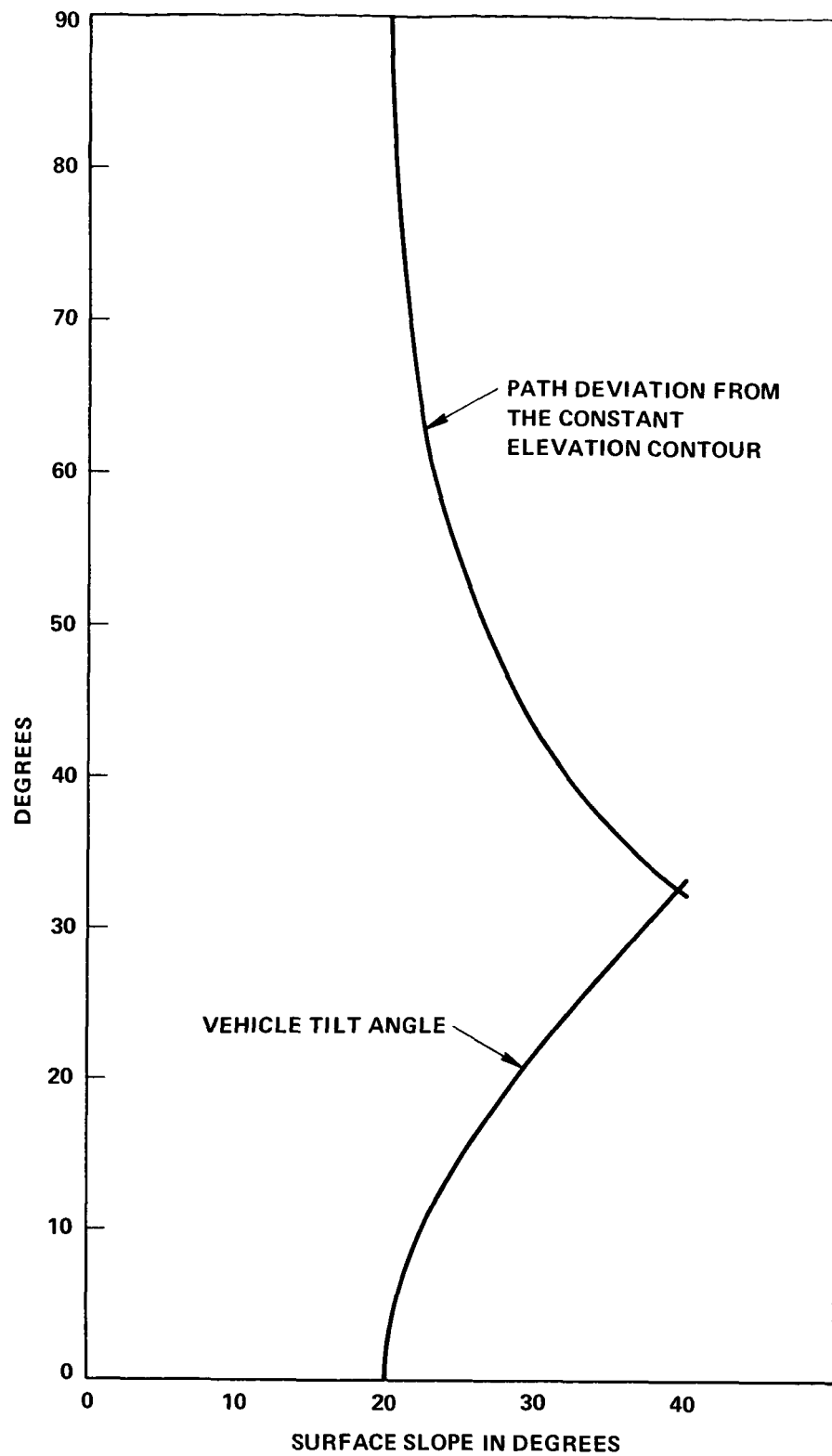


FIGURE 3 - PATH DEVIATION AND VEHICLE TILT FOR 20-DEGREE VEHICLE CLIMB ANGLE



Subject: LRV Tilt During Negotiation
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